Some Economic Considerations Involved in Planning Farms for Soil and Water Conservation at Wooster, Ohio

R. H. Blosser

Department of Rural Economics and Rural Sociology

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Introduction

In planning farms for soil and water conservation consideration should be given to the economic as well as the physical aspects of erosion control and the maintenance of the productivity of the soil. Unless the conservation recommendations are economically feasible, the farmer cannot be expected to adopt them even though the practices may be effective from the conservation standpoint. This study of the Muddy-Fork Soil Conservation Demonstration Project has been made to emphasize the importance of considering the economic implications involved in planning farms for soil and water conservation, and some of the ways in which the recommended conservation practices may be made to fit into an effective farm organization. Case studies will be used to represent the major types of farms in the area and the problems involved in adjusting the present farm organization to meet the requirements for soil and water conservation.

The Muddy-Fork Project was established to demonstrate practical methods of soil and water conservation in the erosion problem area of northeastern Ohio. On each demonstration farm detailed farm plans were developed by the Soil Conservation Service and the farmer in an effort to promote proper land use, control erosion, and maintain or increase the productivity of the soil.

1/ Cooperative Agent, Department of Rural Economics and Rural Sociology, Ohio State University, and Division of Economic Research, Soil Conservation Service, United States Department of Agriculture.

To make the demonstrations effective as soon as possible, the Soil Conservation Service furnished sufficient lime, fertilizer and seed to improve an area of permanent pasture equal to 2 percent of the total farm area, enough lime to grow an alfalfa-clover-timothy mixture of hay on an area equal to 4 percent of the total farm acreage, the required number of trees for an area equal to 3 percent of the total farm area, and a portion of the barbed wire for protecting the forest against destruction by livestock.

Description of the Area 1/

Topography. The Muddy-Fork Demonstration Project comprises approximately 32,500 acres of land, of which one-third is located in Wayne County and the remainder in Ashland County. The upper part of the watershed is an undulating to gently rolling upland. The stream channels and drainageways are small, and on the level areas composed of heavy soils, drainage is a problem. In the southern part of the watershed, the well defined U shaped valley is one to one and one-half miles wide. The slopes of this valley range from 10 percent to 25 percent and rise approximately 75 feet above the bottom of the valley. Beyond these valley walls is a broad undulating to gently rolling upland, which drains into the main stream. The slopes of the valley walls are dissected by small channels which provide good drainage. In fact the drainage is so rapid on many of the slopes that erosion control is a problem. Erosion is greatest in the southern part of the area where the heavier types of soil occur on sloping land.

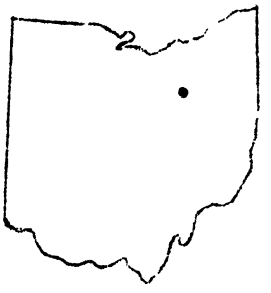

Figure 1. Location of Muddy-Fork Demonstration Project

1/ A detailed description of the area is given in the Muddy-Fork monograph which is available in the offices of the Regional Conservator and the State Coordinator.

Data collected on 69 farms in the area show that 70 percent of the land is composed of slopes less than 7 percent, and only 10 percent of the land in these farms has slopes over 12 percent. These farms should be reasonably representative of the area since they are uniformly distributed in the watershed.

Table I. Slope of Land on 69 Farms Muddy-Fork Watershed

Slope Class percent	Percent of Total Area
0 - 2	26
3 - 6	44
7 - 11	20
12 - 19	4
20 and over	6
Total	100

Source: Monograph, Muddy-Fork Project, P. 37.

The soils are derived from glacial sandstone and shale. Approximately 43 percent of the soil is classified as Rittman, with small amounts of Wooster, Chenango, Wadsworth, Ellsworth, Mahoning, Trumbull, Chippewa and Lobdell occurring in the area. With the exception of the Rittman soil, none of the soil types constitute over 8 percent of the watershed.

Erosion. Table II shows that one-fourth to three-fourths of the original topsoil has been removed from approximately one-third of the cropland. Sheet erosion is the predominant form with gullies appearing only on the steep slopes. Little erosion has occurred in the forests and permanent pasture areas. On the cultivated land erosion is evident on all slopes above 3 percent, and is due to tillage of slopes without regard to the contour, and to rotations consisting of a high percentage of cultivated crops.

Table II. Erosion on 69 Farms in the Muddy-Fork Watershed

Soil Loss percent	Area in each Erosion Class: Entire farm percent	Cropland percent
0 - 24	70	64
25 - 74	27	33
75 - 99	3	3
Total	100	100

Source: Monograph, Muddy-Fork Project, P.26-27

Land Use. In the Muddy-Fork area 110 farm operators agreed to cooperate with the Soil Conservation Service in the demonstration work, but detailed farm management data were obtained on only 78 of the farms. The 110 farms of which three-fourths were operated by owners and one-fourth by tenants, ranged in size from 33 acres to 320 acres with 37 percent of the farms in the 80 acre group, 22 percent in the 120 acre group, and 23 percent in the 160 acre group. In table III, the average size of 78 farms in the area was 124 acres, of

Table III. Land Use on 78 Farms in 1935, Muddy-Fork Watershed

Crop	Average Acreage per farm
Corn, grain	14.4
Corn, silage	2.1
Oats	12.3
Wheat and rye	18.7
Other depleting crops	1.4
Total depleting crops	48.9
Alfalfa hay	1.2
Clover hay	1.4
Mixed hay	15.2
Timothy hay and seed	4.3
Total rotated area	71.0
Permanent pasture	33.0
Woods	13.0
Idle and miscellaneous	7.0
Total Farm Area	124.0

which over one-half was in the rotation. Sixty-nine percent of the rotated area was in depleting crops, and 31 percent was in conserving crops. Although several rotations were followed in the area, the prevailing rotation

was corn, oats, wheat, and hay. On the heavy wet soils where corn planting was often delayed, and harvesting was too late to sow the wheat at the proper time, oats often proved to be a profitable crop in the rotation. Meadows consisting of red clover and timothy were most common in the area. In 1939 hybrid corn was raised on more than one-half of the acreage devoted to this crop.

Livestock. General livestock farming is the prevailing type of agriculture in the area. Practically all of the crops are fed to livestock except wheat which is usually sold as a cash crop. The livestock enterprises shown in table IV consist principally of dairy cattle, poultry, and sheep. The dairy herds are mixed with Guernseys and Holsteins, Guernseys being the predominant breed.

Table IV. Livestock on 78 Farms in 1935, Muddy-Fork Watershed

Class	Animal Units a/
Cows	7.1
Other cattle	2.7
Horses	3.4
Sheep	1.8
Hogs	1.5
Poultry	1.5
Total	18.0

a/ An animal unit is equal to: 1 horse, 1 cow, 2 head of young cattle, 10 ewes, 20 lambs, 3 brood sows, 1400 lbs. gain in hogs, or 100 hens.

In 1935 the labor income on 78 farms averaged $778 with the gross receipts distributed as follows: livestock and livestock products 70 percent, crops 25 percent, and miscellaneous 5 percent. Approximately one-half of the receipts from livestock products was derived from the sale of milk, and one-third from the sale of eggs.

The Recommended Conservation Program

The recommended soil and water conservation program for the Muddy-Fork Watershed provides for (1) proper land use, (2) the control of erosion, and (3) the maintenance of the productivity of the soil. Recommendations for accomplishing these objectives include the use of one or more of the following methods: approved rotations, improvement of the meadows and permanent pastures, strip cropping, contour cultivation, sod waterways, terracing, and woodland management. For the light soils with good drainage a rotation of corn, wheat, meadow, meadow is recommended. For the heavy soils with poor drainage the suggested rotation is corn, oats, wheat, meadow, meadow. In general, oats are included in the rotation for the heavy soils because poor drainage often delays corn planting and thus the crop matures too late in the fall to sow the wheat. On level land the rotation of corn, oats, wheat, meadow, meadow is satisfactory from the stand-point of erosion control, but is not adapted to rolling land where the ground is left bare over winter following the corn crop.

Two years of meadow are included in the recommended rotations, although it is recognized that in exceptional cases where erosion presents no problem, one year of meadow probably would be adequate to maintain the productivity of the soil. Under the prevailing rotation of corn, oats, wheat, meadow and the methods of crop management, it is doubtful whether the farmer could maintain his farm as a producing unit. Data collected by the Ohio Agricultural Experiment Station at Wooster 1/ indicate that yields may be maintained by following this rotation, however, the conditions under which these data were collected were somewhat different from the cropping practices followed by the

1/ Handbook of Experiments in Agronomy, Ohio Agricultural Experiment Station Special Circular No. 53, September 1938, p. 103.

farmers in the area. To maintain yields under this rotation 8 to 10 tons of manure per acre should be applied once every rotation, erosion must be controlled, sufficient lime must be applied to raise an alfalfa hay mixture, and adequate fertilizer must be used. Experiments 1/ also indicate that the productivity of the soil may be maintained with a three year rotation of corn, wheat, meadow, provided the necessary precautions are taken to apply sufficient fertilizer and lime, and also control erosion. As an aid in the control of erosion, and as a means of supplying organic matter to supplement the available manure, a rotation consisting of two years of meadow has been recommended in general for the farms in the demonstration area.

Contour cultivation and contour strip cropping are recommended on land subject to erosion except on slopes below 3 percent with 1 or 2 erosion. 2/ On slopes from 3 percent up to 7 percent with 1, 2, 3, or 33 erosion 3/ contour tillage and contour strip cropping are recommended, the practice used depending upon the steepness of the slopes and the amount of erosion that has already occurred. On slopes from 7 percent up to 12 percent contour strip cropping is planned, the width of the strips depending upon the length and steepness of the slope. If crop land is scarce, slopes from 12 percent up to 15 percent may be cropped provided the slopes are short and contour strip cropping is practiced.

Terraces are recommended on deep soils where the plastic layer is not too close to the surface. Due to the irregular slopes terracing cannot be used on a very large portion of the area. Diversion ditches are recommended for carrying away excess water. Sod waterways should be used to protect natural drainageways from erosion.

1/ Ibid, p. 102.

2/ Class 1 erosion - No apparent accelerated erosion.
Class 2 erosion - Less than 25 percent of topsoil removed.

3/ Class 3 erosion - From 25 percent up to 50 percent of topsoil removed.
Class 33 erosion - From 50 percent up to 75 percent of topsoil removed.

Slopes from 12 percent to 20 percent and land with small gullies should be converted to permanent pasture. Land already in permanent pasture should be improved by an initial treatment of 400 pounds of superphosphate fertilizer and two tons of ground limestone per acre. Subsequent treatments should consist of 400 pounds of superphosphate fertilizer and one ton of ground limestone per acre once every 5 or 6 years.

To grow the recommended alfalfa-mixture meadows 2 tons of ground limestone per acre are generally recommended for the initial treatment followed by one ton per acre once every rotation. The suggested meadow seeding mixtures include 4 pounds of alfalfa, 4 pounds of red clover, 2 pounds of alsike clover and 4 pounds of timothy seed, the latter to be sowed in the fall. Under favorable conditions where more alfalfa is desired 8 pounds of alfalfa and 4 pounds of timothy are recommended. For permanent meadows the seeding mixture should consist of 12 pounds of alfalfa and 3 pounds of timothy. One ton of ground limestone and 400 pounds of fertilizer per acre should be applied each time the permanent meadow is seeded.

Slopes over 20 percent and areas with deep gullies should be considered as potential forest land unless the area is already in trees. The recommended forestry improvement program includes the protection of the woods from livestock, the cutting of undesirable trees, the planting of trees where needed, the protection of the trees from fire, and the marketing of the trees as they mature.

Probable Economic Effects of the Recommended Conservation Program

Feed available. Changing the prevailing rotation of corn, oats, wheat, meadow to either corn, oats, wheat, meadow, meadow or corn, wheat, meadow, meadow will result in the production of more hay and less grain. An improvement in the type of hay also will occur if the recommended alfalfa-meadow mixture is raised. The improvement of the permanent pastures will provide more forage of higher quality. Since at least two years of meadow in the rotation seem advisable from the standpoint of erosion control, the organization of the farm must be on a basis that will provide for a high proportion of hay-consuming livestock. Thus in order to utilize the feed efficiently the farmer should raise dairy cattle, beef cattle, or sheep, the class of livestock raised depending upon such factors as the preference of the farmer, the size of the farm, and available markets.

A survey of the farms under agreement in the area showed that out of 103 rotations planned by the Soil Conservation Service, 67 were being followed and 36 had been discontinued by the farmers. Failure to adjust the livestock feeding practices under the new farm organization was responsible for 27 of the 36 rotations being discontinued. An examination of the feeding practices on these 27 farms showed that the farmers had failed either to produce better quality hay, or to substitute hay for corn stover in the ration. If the maximum amount of hay is to be substituted for grain in the ration, hay of the highest quality must be available. On many farms in the area the hay produced under the demonstration program was not of the highest quality, and therefore the farmer had considerable difficulty in making the necessary adjustments. Under the demonstration program, the Soil Conservation Service changed the entire rotation to include two years of hay, but this agency furnished lime for only the demonstration meadow areas. Since many of the

farmers did not lime the remainder of the crop land, the hay produced on the second-year meadows was often inferior to that produced on the first-year meadows under the old methods of farming. This situation was due to the fact that all of the conservation recommendations were not put into operation, and illustrates the importance of fitting the conservation program into the general farm organization.

Labor and power. On most farms the labor and power demands will be reduced under the new farm organization. More labor and power will be required to make the additional hay, but less will be needed to raise the smaller acreage of grain. Although more hay will be made under the recommended conservation plans, no greater peaks in the demand for labor and power will occur since the first cutting of hay will be made before the wheat is cut and also before the corn is cultivated for the last time. Under the prevailing methods of farming, the harvesting of clover-timothy hay came in the same period as wheat harvesting and the last cultivation of the corn. One of the problems of the farmer will be to utilize profitably the labor and power saved in crop production, otherwise this saving in labor may actually result in a decrease in net farm income on some of the farms.

Labor income. When the conservation program is in full operation most of the farmers should be able to maintain or even increase their labor incomes with only minor adjustments. Under the prevailing methods of farming the amount of hay and pasture produced was inadequate for the number of hay-consuming animals kept. Under these conditions many farmers fed more grain than would have been required if adequate hay and pasture had been available. On other farms the livestock was underfed.

In order to adapt the recommended conservation program to the present farm organization some adjustments usually will be necessary. For example, on the large farm that is owner-operated, current expenses may be reduced by

hiring less labor since less will be required under the revised cropping plans. On the large farm that is tenant-operated and on the small farm where a maximum volume of business is desired additional livestock may be kept in order to maintain the farm income. During the transition period labor income may decline slightly on many farms due to the fact that returns from lime and fertilizer are not realized before several years have elapsed. However, when the conservation program is in full operation annual expenditures for maintaining these improved practices may be considered as a replacement cost instead of an additional cash outlay that produces returns at a later time.

Selection of Case Studies to Illustrate Representative Farm Situations

An analysis of the economic problems involved in planning farms for soil and water conservation, and some of the ways in which the recommended conservation program may be made to fit in with the prevailing farm organization, will be made on four farms. These farms were selected after the group had been sorted according to type of soil, tenure, and size of farm. No sorts were made on type of farming since practically all of the farmers followed a general livestock system of farming. Eighty-two percent of the farms in table V ranged in size from 60 to 179 acres. Most of the tracts in the 20 to 59 acre group were parts of larger farming units. From the group of 110 farms, case studies have been selected to represent the 60 to 99 acre groups with light and heavy soils; also the 140 to 179 acre group with light and heavy soils. The problems involved on the farms of 100 to 139 acres represent a combination of the ones in the four groups studied. Only owner-operated farms were selected for detailed analysis, but consideration also will be given to differences in adjustment for tenant-operated farms.

Table V. Number of Farms Sorted According to Type of Soil, Size, and Tenure, Muddy-Fork Watershed, 1936

Size of farm Acres	Light Soils		Heavy Soils		Total Number of farms
	Owners	Tenants	Owners	Tenants	
20 - 59	3	0	5	0	8
60 - 99	8	5	23	5	41
100 - 139	8	4	9	3	24
140 - 179	7	5	10	3	25
180 - 219	4	1	3	0	8
220 - 259	0	0	1	1	2
260 - 299	0	0	0	0	0
300 - 339	1	1	0	0	2
Total	31	16	51	12	110

Case Study of an 80-Acre Farm with Heavy Soil

Land Use. This farm was selected to represent the problems involved in planning for a group of farms constituting 25 percent of the farms in the area. Table VI shows the land use for the prevailing methods of farming in 1936, and the planned acreage of crops for the years 1937 to 1941. The rotated area will remain practically the same under the revised farm plans. Recommendations include a change from the prevailing rotation of corn, oats, wheat, meadow to corn, oats, wheat, meadow, meadow. This will result in a reduction of 26 percent in the depleting crops and an increase of 75 percent in the conserving crops. Due to the heavy soils on this farm, the corn is often planted too late to mature in time to sow wheat. Therefore, oats have been included in the rotation since they can be sowed in the spring. Also, this crop produces higher yields on the heavy soils than on the light soils in the area. No contour strip cropping was planned, but contour cultivation was recommended for 35 acres of the crop land. Recommendations also include treatment of the permanent pasture with lime and fertilizer , and protection of the woods from livestock.

Table VI. Prevailing Land Use in 1936 and that Proposed for Subsequent Years for an 80-Acre Farm with Heavy Soil, Muddy-Fork Watershed

Crop	1936	1937	1938	1939	1940	1941
Corn	12.0	10.1	10.0	8.6	9.2	8.5
Oats	12.0	9.2	10.1	10.0	8.6	8.5
Wheat	12.0	14.2	15.0	10.1	10.0	9.5
Depleting crops	36.0	33.5	35.1	28.7	27.8	26.5
Alfalfa hay	0.0	0.0	4.0	4.0	4.0	4.0
Mixed hay	12.0 a/	14.0 a/	8.4 b/	14.8 b/	15.7 b/	17.0 b/
Total hay	12.0	14.0	12.4	18.8	19.7	21.0
Rotated area	48.0	47.5	47.5	47.5	47.5	47.5
Woods	10.0	10.0	10.0	10.0	10.0	10.0
Perm. pasture	16.0	20.0	20.0	20.0	20.0	20.0
Idle & Misc.	6.0	2.5	2.5	2.5	2.5	2.5
Total	80.0	80.0	80.0	80.0	80.0	80.0

a/ Clover-timothy.
b/ Alfalfa-clover-timothy.

By 1941 the proposed changes in the rotation of the crops had been made, but contour cultivation was followed on only a portion of the area designated in the original plans. Since the slopes on this farm are somewhat irregular, contour cultivation is extremely difficult to follow on all of the 35 acres. Approximately three-fourths of the crop land had been limed by 1941, but only the demonstration pasture area of 2 acres had been treated with lime and fertilizer. Lack of operating capital was the reason given by the operator for not improving the cropland and permanent pasture at a more rapid rate. Three acres of waste land had been reforested and pasturing the woodlot had been discontinued.

Livestock. The livestock kept in 1936 consisted of the following animal units 1/: horses 3.0, dairy cows 6.0, young cattle 1.5, hogs 1.0 and poultry 1.0. Of the 12.5 animal units of livestock kept 10.5 were hay-consuming animals. The three horses furnished all of the power on the farm. The young cattle were of dairy type, and were raised for replacing the old cows in the dairy herd.

1/ An animal unit is equal to: 1 horse, 1 cow, 2 head of young cattle, 3 brood sows, 1400 lbs. gain in hogs, or 100 hens.

Productivity balance. The annual changes in the productivity of the cropland have been calculated in table VII. Under the new farm plans the productivity of the cropland has been estimated to increase .1 percent annually, whereas under the farming methods used in 1936, it was estimated to be declining at the rate of .6 percent each year. 1/ The calculated increase in soil productivity was due to a reduction in depleting crops, an increase in conserving crops, a decrease in erosion losses, and the change from clover-timothy to alfalfa-clover-timothy hay.

Table VII. Productivity Balance a/ of the Crop Land Under the Prevailing and Proposed Methods of Farming on an 80-acre Farm with Heavy Soil, Muddy-Fork Watershed

	Prevailing practices	Proposed practices
Gain from fertility practices, points	20	20
Gain from conserving crops, points	15	30
Loss from erosion, points	18	8
Loss from depleting crops, points	48	35
Productivity balance, percent b/	- .6	+.1

a/ For method of calculation see: Salter, R. M., Lewis, R. D., and Slipher, J. A. - Our Heritage, The Soil. Ohio State University, Extension Service Bulletin 175, 1936.

b/ Net change in points divided by crop acres.

1/ This method of calculating the rate of soil derletion was developed by the Ohio Agricultural Experiment Station and is based on the percentage of depleting and conserving crops in the rotation, fertility practices, and erosion control. For example, each crop of corn is estimated to deplete the productivity of the soil 2 percent, wheat 1 percent, and oats 1 percent. First year alfalfa is estimated to increase the productivity of the soil 2-1/2 percent and red clover 2 percent. Other crops were calculated at their respective values which are based on experimental data. Credit was also given to the beneficial effects of fertilizer and manure, and erosion control practices.

Feed available. In table VIII calculations have been made to show the amount of feed needed for the livestock kept in 1936, and the amount of feed produced under the prevailing and proposed methods of farming. Under the prevailing methods of farming sufficient grain was produced, but the amount of hay and pasture raised was inadequate to meet the recommended feeding standards for the livestock. This deficiency was met either by underfeeding the hay-consuming livestock or feeding rations composed of too high a propor-

Table VIII. Grain and Roughage Needed for the Amount of Livestock Kept in 1936 and the Feed Available Under the Prevailing and Proposed Methods of Farming for an 80-acre Farm with Heavy Soil, Muddy-Fork Watershed

Crop	Feed needed a/	Feed Produced	
		Prevailing practices b/	Proposed practices c/
Corn, bu.	374	456	365
Oats, bu.	204	480	357
Wheat, bu.	48	240	209
Hay, ton	21	15	23
Permanent pasture, A. U.	11	5 d/	12 e/
Supplementary pasture, A. U.	11	5 f/	12 g/

a/ See appendix table A for standards used.
b/ Based on 1936 acreage of crops and following yields: corn, 38 bu.; oats, 40 bu.; wheat, 20 bu.; and hay 1-1/4 tons per acre.
c/ Based on 1941 acreage of crops and following yields: corn, 43 bu.; oats, 42 bu.; wheat, 22 bu.; and alfalfa-clover-timothy hay 1-1/4 tons first cutting, and 3/4 ton per acre second cutting.
d/ 3 acres of untreated permanent pasture to 1 animal unit.
e/ 1-1/2 acres of treated permanent pasture to 1 animal unit.
f/ 2-1/2 acres of poor supplementary pasture to 1 animal unit.
g/ 1-1/4 acres of good supplementary pasture to 1 animal unit.

tion of grain. Corn stover has been omitted from the calculations, since it is planned that this crop will be fed in addition to all of the hay that the animals will consume. Assuming a slight increase in the production of grain per acre, less grain but more hay and pasture will be produced under the recommended conservation program. Under the prevailing methods of farming, 960 feed units 1/ of grain were produced whereas under the proposed conservation plans 773 feed units are estimated to be available. Since the first

1/ A feed unit is equal to: 1 bu. corn, 2 bu. oats or .9 bu. wheat.

cutting of alfalfa-clover-timothy hay should be sufficient to meet the hay standards for the amount of livestock kept in 1936, the meadows may be used for supplementary pasture for the remainder of the year. Some supplementary pasture was used in 1941, but more will be used in the future according to the plans of the farmer. The proposed conservation plans should produce no additional problems in providing for supplementary pasture since no contour strip cropping has been planned for this farm.

Labor and power. According to the computations in table IX labor and power demands for crop production will decrease under the proposed conservation plans. This reduction has been estimated at 21 percent for labor and 19 percent for power. Although considerably less labor and power will be used for grain production, slightly more will be needed for making the additional hay and improving the permanent pasture. The 1936 acreage of crops was used in the calculations for the prevailing practices, while the 1941 acreage served as a basis for computing the quantities under the proposed farm organization.

Table IX. Labor and Power Demands a/ Under the Prevailing and Proposed Methods of Farming for an 80-acre Farm with Heavy Soil, Muddy-Fork Watershed

Crop	Prevailing practices		Proposed practices	
	Man Hours	Horse Hours	Man Hours	Horse Hours
Corn	480	468	340	331
Oats	204	300	144	212
Wheat	204	300	161	237
Hay	83	108	110	153
Pasture	0	0	8	16
Total	971	1176	763	949

a/ Based on labor standards in the following publication; Baker, H. H - Labor Requirements for Crop Production in Ohio. Dept. of Rural Economics, Ohio State University, Mimeo. Bull. No. 115, 1938.

A study of the distribution of labor in figure 2 shows that under the proposed farm plans labor peaks will not be any greater than they were when the farmer followed the prevailing practices. Hay making, wheat cutting, and corn cultivation for the last time came in the same period under the old

methods of farming. Although more hay will be made after the recommended conservation program is in full operation, the labor peak during the hay making season should cause no difficulty since most of the hay will be made before wheat harvest and before the last cultivation of corn.

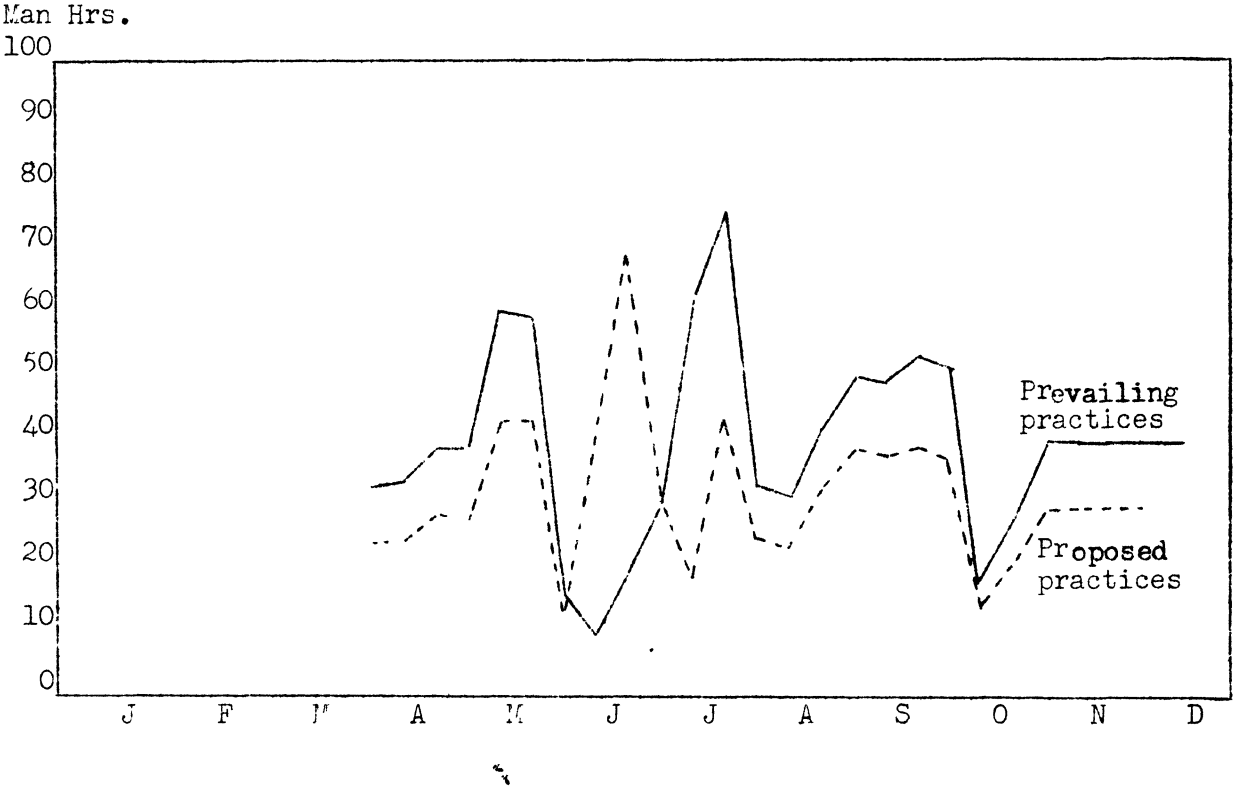

Figure 2. Labor Distribution on Crops Under the Prevailing and Proposed Methods of Farming for an 80-acre Farm with Heavy Soil, Muddy-Fork Watershed

Labor income. Calculations in table X show the probable net effect on labor income assuming the recommended conservation program is adopted and no change is made from the amount or type of livestock kept in 1936. To reduce the computations to the minimum and avoid duplication, only the items of receipts and expenses that may be expected to change have been considered. Under the prevailing methods of farming the calculated sale value of the grain and hay and the feed value of the pasture was $646 for grain, $120 for hay and $46 for pasture, whereas under the revised farm plans, grain was $522, hay $108, and pasture $99. This gives a reduction of $23 in the calculated value of the crops available for sale in the recommended conservation program

Table X. Calculated Change in Receipts, Expenses, and Labor Income Assuming the Recommended Conservation Program is Adopted and no Change in Livestock is Made on an 80-acre Farm with Heavy Soil, Muddy-Fork Watershed

	Dollars
Decrease in Receipts	
Crops	23
Increase in Costs	
Lime, fertilizer and seed	38
Fence	2
Decrease in Costs	
Feed bought	16
Threshing	9
Labor and power	86
Increase in Income	48

is adopted. A net increase in the expenses for lime and fertilizer will occur due to the improvement of the meadows and permanent pasture, although less fertilizer will be applied to the grain crops. Less protein feed will be necessary after the meadows and permanent pasture are improved. By reducing the acreage of grain, less labor and power will be required, however, this situation will not affect expenses since labor and power on this farm is largely a fixed item. Although the labor income under the proposed farm organization has been calculated to increase $48, a decrease in labor income may actually occur unless the farmer can reduce his cash expenditures for labor and power. Due to the fact that practically no labor or power is hired on this farm, the problem of adjusting the farm business to the recommended conservation program suggests the profitable utilization of this labor and power in some other manner.

Computations in table XI show the changes in receipts, expenses, and income assuming the proposed conservation practices are adopted and one more dairy cow is kept. The better utilization of the land devoted to meadows and permanent pasture shows an estimated increase of $73 in labor income and savings of $41 in labor and power. This represents a difference of $32 increase in

Table XI. Calculated Change in Receipts, Expenses and Labor Income Assuming the Recommended Conservation Program is Adopted and One More Dairy Cow is Kept on an 80-acre Farm with Heavy Soil, Muddy-Fork Watershed

	Dollars
Increase in Receipts	
Sale of milk	90
Decrease in Receipts	
Crops	37
Increase in Costs	
Lime, fertilizer and seed	38
Fence	2
Decrease in Costs	
Feed bought	10
Threshing	9
Labor and power	41
Increase in Income	73

labor income under the new farm organization assuming no effort is made to use in any other way the labor and power estimated at $41. If an additional dairy cow were kept under the recommended conservation program the calculated amount of labor used would still be 58 hours less than the amount needed for operating the farm according to the prevailing methods.

The amount and type of livestock kept in 1941 was practically the same as in 1936. Although some improvement had been made in the type of hay, and the production of this crop had increased, livestock numbers remained the same, but better feeding practices were followed. This situation illustrates the importance of the time element involved, since several years must elapse before the production of hay on many farms can be increased enough to provide sufficient feed for additional livestock.

Consideration also should be given to the change in the rate of soil depletion under the two methods of farming and its probable effect upon labor income. Under the soil depleting methods of farming, crop yields and labor income decline, whereas soil conserving methods provide for the maintenance of

the farm as a producing unit. Since no sheep are raised on this farm consideration will not be given to this enterprise as a possible means of utilizing the meadows and pasture more efficiently. A later case farm will serve to illustrate the use of adjustments in the sheep enterprise as a means of adapting the conservation recommendations to a specific farm.

According to the computations in tables X and XI only minor adjustments will be necessary in order to maintain the labor income on this farm. However, during the transition period receipts will be less, and expenses will be more than they will be when the program is in full operation. This is due to the fact that the initial treatment of the meadows and permanent pasture demands twice as much lime as subsequent treatments. Also, no improvements in the meadows can be expected before two years have elapsed. On this farm approximately $125 less income will be available annually during the transition period from the prevailing to the recommended methods of farming. Adjustments during this period may suggest the adoption of practices that will produce returns within a relatively short period of time. For example, the meadows might be improved first, and then the necessary reductions in the acreage of grain crops could be made.

Case Study of an 80-acre Farm with Light Soil

Land Use. This farm was selected to illustrate some of the problems that should be considered in reorganizing small farms with light soils for soil and water conservation. The proolems involved on this farm should be fairly representative of the conditions on approximately 12 percent of the farms in the area. Table XII shows the proposed changes in land use from the prevailing to the recommended systems of farming. The suggested changes include a 11 percent reduction in the rotated area and a 17 percent increase in the acreage of permanent pasture. Recommendations include a change from the prevailing rotation of corn, oats, wheat, meadow to corn, wheat, meadow, meadow. This change will reduce the acreage in depleting crops 44 percent and increase

Table XII. Prevailing Land Use in 1936 and that Proposed for Subsequent Years for an 80-acre Farm with Light Soil, Muddy-Fork Watershed

Crop	1936	1937	1938	1939	1940	1941
Corn, grain	8.0	6.5	6.1	8.0	8.0	9.0
Corn, silage	4.0	0.0	0.0	0.0	0.0	0.0
Oats	6.0	6.9	0.0	0.0	0.0	0.0
Wheat	10.0	13.6	10.3	6.1	10.6	10.0
Depleting crops	34.0	27.0	16.4	14.1	18.6	19.0
Alfalfa hay	0.0	0.0	4.0	4.0	4.0	4.0
Mixed hay	12.0 a/	15.4 a/	22.0 b/	22.5 b/	18.0 b/	18.0 b/
Total hay	12.0	15.4	26.0	26.5	22.0	22.0
Rotated area	46.0	42.4	42.4	40.6	40.6	41.0
Woods	8.0	9.0	9.0	9.0	9.0	9.0
Perm. pasture	23.0	25.6	25.6	27.4	27.4	27.0
Idle & Misc.	3.0	3.0	3.0	3.0	3.0	3.0
Total	80.0	80.0	80.0	80.0	80.0	80.0

a/ Clover-timothy
b/ Alfalfa-clover-timothy.

the acreage of hay 83 percent. The elimination of oats from the rotation has been suggested because this crop produces low yields on the light soils, and does not furnish any protection to the soil during the winter months. No contour strip cropping is planned but recommendations include contour cultivation on 19 acres of the cropland. Additional conservation measures provide for liming and fertilizing the permanent pasture and protecting the woods from livestock.

The proposed cropping plans for 1940 and 1941 were followed by the operator with the exception that oats were substituted for a small amount of the corn acreage in the original plans. The reduction in the acreage of corn was necessary to comply with the Agricultural Conservation Program which paid for compliance $93 for 1938, $90 for 1939 and $69 for 1940. Contour cultivation has been followed, and all of the cropland except 13 acres was limed by 1941. No permanent pasture except the two acres that had been treated by the Soil Conservation Service had been improved by 1941, however, the operator plans to improve the permanent pasture as soon as all of the cropland has been limed.

Since the operator has not used an alfalfa-clover-timothy mixture for seeding the meadows, the second year hay has been principally timothy. This situation stresses the importance of liming the cropland and raising alfalfa in the meadow mixture, otherwise the second year hay will be of an unsatisfactory type.

Livestock. The livestock kept in 1936 consisted of the following animal units: Horses 2.0, dairy cows 7.0, young cattle 2.0, hogs .5, and poultry 1.5. Holstein cows constituted the dairy herd. Eleven of the 13 animal units kept were hay-consuming livestock. The horses furnished all of the power used on the farm.

Productivity balance. Losses in the productivity of the soil have been calculated at .5 percent annually on the basis of the cropping practices followed in 1936. Under the proposed conservation program the productivity of the soil is estimated to increase .5 percent annually. This change in soil productivity should result in increased crop yields. Table XIII shows that the calculated change in the productivity of the soil resulted from the additional gains from conserving crops and the reduction in the losses from depleting crops and erosion.

Table XIII. Productivity Balance a/ of the Crop Land Under the Prevailing and Proposed Methods of Farming on an 80-acre Farm with Light Soil, Muddy-Fork Area

	Prevailing practices	Proposed practices
Gain from fertility practices, points	20	20
Gain from conserving crops, points	15	33
Loss from erosion, points	13	3
Loss from depleting crops, points	46	28
Productivity balance, percent b/	-.5	+.5

a/ For method of calculation see: Salter, R. M., Lewis, R. D., and Slipher, J. A. - Our Heritage, The Soil. Ohio State University, Extension Service Bulletin 175, 1936.

b/ Net change in points divided by crop acres.

Feed available. Calculations in table XIV have been made to compare the amount of feed needed for the livestock kept in 1936 and the amount produced under the prevailing and proposed methods of farming. On the basis of the recommended feeding standards sufficient grain was produced under the prevailing farm practices but the amount of hay and pasture was inadequate for the livestock kept. Under the soil depleting methods of farming 830 feed units 1/

Table XIV. Grain and Roughage Used for the Amount of Livestock Kept in 1936 and the Feed Available Under the Prevailing and Proposed Methods of Farming for an 80-acre Farm with Light Soil, Muddy-Fork Watershed

Crop	Feed Needed a/	Feed Produced	
		Prevailing practices b/	Proposed practices c/
Corn, bu.	446	320	450
Oats, bu.	35	210	0
Wheat, bu.	66	368	250
Silage, ton	27	27	30
Hay, ton	13	13	14
Permanent past. A.U.	11	7 d/	12 e/
Supplementary past. A. U.	11	5 f/	12 g/

a/ See appendix table B for standards used.
b/ Based on 1936 acreage of crops and following yields: corn, 40 bu.; corn silage, 7 tons; oats, 35 bu.; wheat, 23 bu.; and hay 1-1/4 tons per acre.
c/ Based on 1941 acreage of crops and following yields: corn, 50 bu.; wheat, 25 bu.; alfalfa-clover-timothy hay 1-1/4 tons first cutting, 3/4 tons second cutting; and hay silage 3-3/4 tons per acre.
d/ 3 acres of untreated permanent pasture to 1 animal unit.
e/ 1-1/2 acres of treated permanent pasture to 1 animal unit.
f/ 2-1/2 acres of poor supplementary pasture to 1 animal unit.
g/ 1-1/4 acres of good supplementary pasture to 1 animal unit.

of grain were produced, as compared with 725 feed units under the recommended conservation program assuming grass silage is substituted for corn silage, or 525 feed units if the use of corn silage is continued. Since 537 feed units of grain are estimated to be needed for the livestock kept in 1936, the amount of grain produced will be inadequate under the new farm organization unless hay silage is substituted for corn silage in the ration.

In the calculations it is planned that corn stover will not be substituted for hay, but will be fed in addition to all of the hay that the live-

1/ A feed unit is equal to: 1 bu. corn, 2 bu. oats, or .9 bu. wheat.

stock will consume. The meadows will be used for supplementary pasture after the first cutting is made, since the first cutting should produce enough hay to meet the standards of the livestock kept. Since no contour strip cropping is recommended, no additional problems should be created in regard to pasturing the meadows after the first crop of hay is made.

Labor and power. Labor and power demands in table XV have been calculated to decrease under the new farm organization. The decrease in labor is estimated at 27 percent and the reduction in power 37 percent. The reduction in the acreage of wheat and the elimination of oats in the rotation are largely responsible

Table XV. Labor and Power Demands a/ Under the Prevailing and Proposed Methods of Farming for an 80-acre Farm with Light Soil, Muddy-Fork Watershed

Crop	Prevailing Practices		Proposed Practices	
	Man Hours	Horse Hours	Man Hours	Horse Hours
Corn, grain	320	312	360	351
Corn, silage	116	184	0	0
Oats	102	150	0	0
Wheat	239	340	115	150
Hay, silage	0	0	65	65
Hay	68	94	68	94
Pasture	0	0	8	16
Total	845	1080	616	676

a/ Based on labor standards in the following publication: Baker, R. H. - Labor Requirements for Crop Production in Ohio. Dept. of Rural Economics, Ohio State University, Mimeo. Bull. No. 115, 1938.

for these decreases in labor and power demands. When oats were included in the rotation the ground was plowed for corn, oats and wheat. By eliminating oats the seedbed for wheat may be prepared by disking instead of plowing, thus reducing the amount of labor and power applied per acre of wheat.

The labor distribution in figure 3 shows that a peak will occur during the hay-making season. However, this should cause no serious problems since no greater labor peaks will occur under the recommended conservation program than under the prevailing methods of farming. The substitution of grass silage for corn silage will reduce the labor and power demands in the early part of September.

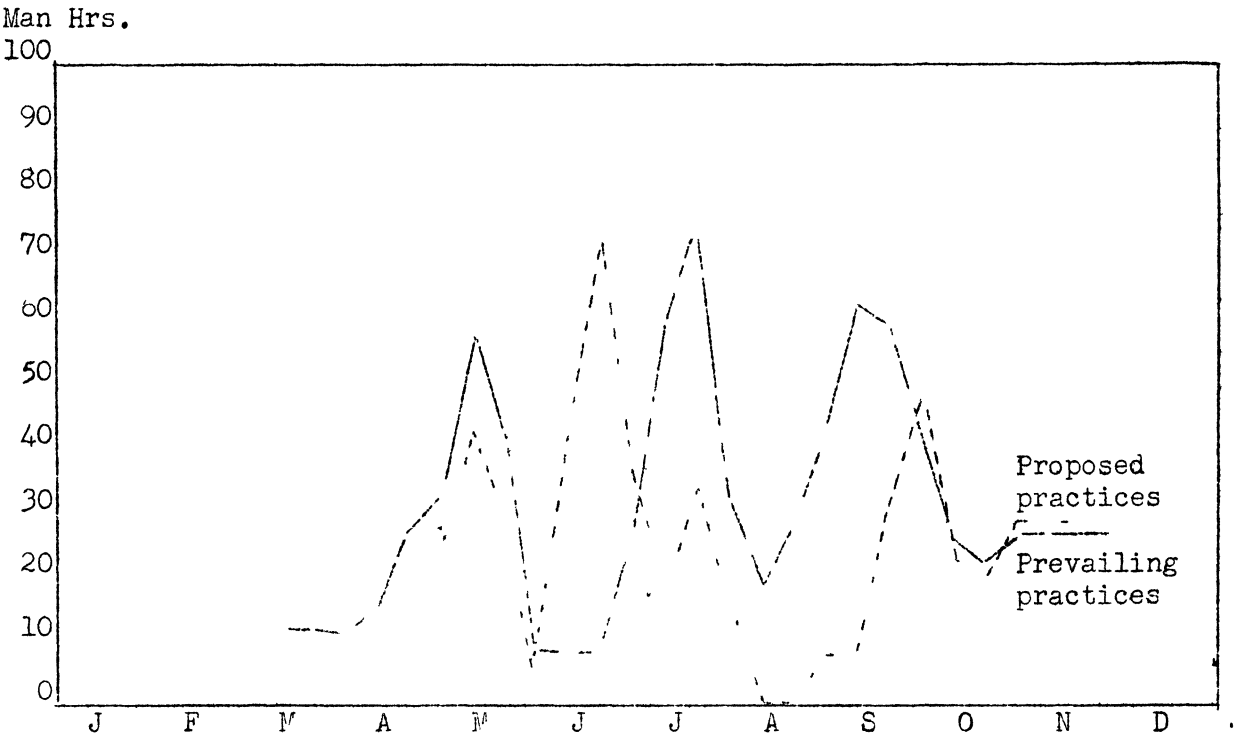

Figure 3. Labor Distribution on Crops Under the Prevailing and Proposed Methods of Farming for an 80-acre Farm with Light Soil, Muddy-Fork Area

Labor income. Some adjustments in livestock production and feeding practices will be necessary to fit the recommended conservation program into the prevailing farm organization. Table XVI shows that a net decrease in labor income may be expected under the new farm organization, if no changes

Table XVI. Calculated Change in Receipts, Expenses, and Labor Income Assuming the Recommended Conservation Program is Adopted and no Change in Livestock is Made on an 80-acre Farm with Light Soil, Muddy-Fork Watershed

(Based on use of corn silage)

	Dollars
Decrease in Receipts	
Crops	175
Increase in Costs	
Lime, fertilizer and seed	15
Fence	7
Decrease in Costs	
Feed bought	10
Threshing	14
Labor and power	150
Decrease in Income	23

are made in the amount and type of livestock, and the silo is filled with corn. If consideration is given to the fact that cash outlays for labor and power on this farm cannot be reduced the net labor income may be expected to decline more than $23 indicated in this table. The reduction of $175 in the sale of crops resulted from the decrease in the acreage of grain and also from a small amount of unharvested hay that might have been sold or fed to additional livestock.

In table XVII calculations have been made on the assumption that the silo will be filled with grass silage instead of corn silage. In this case the calculated increase in income would be $65, with a saving in labor and power of $118. Since this farmer hires practically no labor and keeps only two horses, reductions in the cash outlay for labor and power are almost impossible. Therefore, if the labor and power that is saved is not used profitably in some other manner the labor income under the new farm organization may actually decline. This situation may be met by raising more hay-consuming animals.

Table XVII. Calculated Change in Receipts, Expenses and Labor Income Assuming the Recommended Conservation Program is Adopted and no Change in Livestock is Made on an 80-Acre Farm with Light Soil, Muddy-Fork Watershed
(Based on the substitution of grass silage for corn silage)

	Dollars
Decrease in Receipts	
Crops	55
Increase in Costs	
Lime, fertilizer and seed	15
Fence	7
Decrease in Costs	
Feed bought	14
Threshing	10
Labor and power	118
Increase in Income	65

Since no sheep or beef cattle are raised on this farm expansion of the dairy enterprise probably would be most profitable. However, if the farmer were

interested in the sheep or beef cattle enterprises, consideration should be given to raising these types of livestock. An example of adjustment by means of the sheep enterprise will be given later in this report. By keeping an additional dairy cow, the calculations in table XVIII indicate that labor income can be maintained even though no attempt is made to use in some other manner the labor and power estimated at $73. This change in the dairy enterprise would still use 79 less man hours than under the old methods of farming. During the transition period additional expenditures will be necessary from which returns will not be realized immediately. Thus, the adoption of practices that will produce returns within a relatively short period of time may be the practical

Table XVIII. Calculated Change in Receipts, Expenses, and Labor Income Assuming the Recommended Conservation Program is Adopted, And One More Dairy Cow is Kept on an 80-acre Farm with Light Soil, Muddy-Fork Watershed (Based on the substitution of grass silage for corn silage)

	Dollars
Increase in Receipts	
Sale of Milk	90
Decrease in Receipts	
Crops	69
Increase in Costs	
Lime, fertilizer and seed	15
Fence	7
Decrease in Costs	
Feed bought	8
Threshing	10
Labor and power	73
Increase in Income	90

procedure for the farmer to follow during the early stages of the transition period. Calculations in tables XVII and XVIII have been made on the assumption that grass silage would be substituted for corn silage. Since the farm operator has never had any experience with the making and feeding of grass silage he has continued to fill the silo with corn and has not considered in detail the advantages that might be obtained from the use of grass silage. To utilize labor,

power, and feed most efficiently, the keeping of an additional dairy cow was suggested in table XVIII. This change was made by the farmer by 1941 through increasing the number of dairy cows from 7 to 8 and increasing the amount of young cattle from 2 to 3 animal units.

Additional Considerations for a 155-acre Farm with Heavy Soil

Land Use. This farm illustrates some of the problems involved in planning for soil and water conservation on large farms with heavy soils. Table XIX shows the land use for the prevailing methods of farming in 1936 and the proposed acreage of crops for the period 1937-41. The changes in the rotation for this farm are the same as the recommendations for the first case farm. No contour strip cropping was planned but contour cultivation was recommended for all of the rotated land.

Table XIX. Prevailing Land Use for 1936 and that Proposed for Subsequent Years for a 155-acre Farm with Heavy Soil, Muddy-Fork Watershed

Crop	1936	1937	1938	1939	1940	1941
Corn	22.0	14.5	20.0	15.6	16.8	16.5
Oats	1o.0	15.3	14.5	20.0	15.6	16.5
Wheat	28.0	16.8	15.3	14.5	20.0	16.5
Depleting crops	66.0	46.6	49.8	50.1	52.4	49.5
Mixed hay	22.0 a/	23.2 a/	1p.8 b/	32.1 b/	29.8 b/	33.0 b/
Rotated area	88.0	69.8	66.6	82.2	82.2	82.5
Woods	15.0	15.0	15.0	15.0	15.0	15.0
Permanent pasture	42.0	60.2	63.4	47.8	47.8	47.8
Idle & Misc.	10.0	10.0	10.0	10.0	10.0	10.0
Total	155.0	155.0	155.0	155,0	155.0	155.0

a/ Clover-timothy.
b/ Alfalfa-clover-timothy.

The cropping plan followed by the operator of this farm in 1941 was similar to the recommendations in table XIX. Corn was grown on 15 acres, oats on 16 acres, wheat on 15 acres, and hay on 31 acres of the rotated land. The acreage of corn and wheat was slightly below the planned acreage due to cooperation with the Agricultural Conservation Program which paid for compliance $90 for 1938, $110 for 1939, and $123 for 1940. By 1941 one-half of the cropland had

been limed, but no alfalfa had been included in the meadow seedings. Also 6 acres of permanent pasture had been treated with lime and fertilizer.

Livestock. The livestock kept in 1936 consisted of the following animal units: horses 2.0, dairy cows 10.0, young cattle 3.0, sheep 3.5, hogs 1.0, and poultry 2.0. All but 3.0 of the 21.5 animal units are classified as hay-consuming animals.

Productivity balance. The calculated changes in the productivity balance of the soil are similar to the computations for the preceding case farms. Under the new farm plans the productivity of the cropland is estimated to be stabilized whereas under the depleting methods of farming in 1936 it was calculated to be declining at the annual rate of .6 percent.

Feed available. Under the proposed methods of farming less grain, but more hay and pasture will be available. According to computations the following amount of feed was needed for the livestock kept in 1936: 837 feed units 1/ of grain, 36 tons of hay, and pasture for 19 animal units. Under the prevailing farming practices followed in 1936 the amount of feed produced was as follows: grain 1,772 feed units, hay 27 tons, and pasture for 12 animal units. Under the conservation plans the amount of feed produced will be adequate to meet the demands of the amount and type of livestock kept in 1936, but the number of feed units of grain have been calculated to decline to 1,455.

Labor and power. Calculations show the following reductions in labor and power under the proposed conservation plans: labor 13 percent, horse power 9 percent, and tractor power 23 percent. The distribution of labor is similar to the seasonal demands for the two preceding case studies.

Labor income. Although calculations indicated that additional livestock must be kept on the two preceding case farms to maintain labor income, at least two alternatives will be open to the operator of this farm. One method is to reduce the cash expenses by hiring less labor, and by using the tractor

1/ A feed unit is equal to 1 bu. corn, 2 bu. oats, or .9 bu. wheat.

less. Reductions of this type are possible on the larger farms in the area. The other possibility is to increase the amount of livestock slightly by keeping one more dairy cow or 10 more ewes. Either method of adjustment should enable the farmer to maintain or increase the farm income and at the same time conserve the farm as a producing unit.

Additional Considerations for a 167-Acre Farm with Light Soil

Land Use. This farm represents approximately 11 percent of the farms in the area. Table XX shows the land use for 1936 and the recommended cropping plans for the period 1937-41. The changes in the rotation are the same as outlined for the 80-acre case farm with light soil. Under the new farm plans

Table XX. Prevailing Land Use for 1936 and that Proposed for Subsequent Years for a 167-acre farm with Heavy Soil, Muddy-Fork Watershed

Crop	1936	1937	1938	1939	1940	1941
Corn, grain	24.0	25.6	22.5	21.1	24.8	23.0
Corn, silage	4.0	0.0	0.0	0.0	0.0	0.0
Oats	20.0	0.0	0.0	0.0	0.0	0.0
Wheat	35.0	35.1	32.0	22.0	21.1	25.0
Depleting crops	83.0	60.7	54.5	43.1	45.9	48.0
Mixed hay	40.0 a/	56.9 a/	57.8 b/	56.4 b/	53.6 b/	52.0 b/
Rotated area	123.0	117.6	112.3	99.5	99.5	100.0
Woods	12.0	12.0	18.0	18.0	18.0	18.0
Permanent pasture	26.0	32.4	31.7	44.5	44.5	44.5
Idle & Misc.	6.0	5.0	5.0	5.0	5.0	4.5
Total	167.0	167.0	167.0	167.0	167.0	167.0

a/ Clover-timothy.
b/ Alfalfa-clover-timothy.

recommendations include contour strip cropping on 59 acres, contour tillage on 19 acres, and terraces on 12 acres.

The acreage of the crops grown in 1941 deviated somewhat from the proposed plans due to cooperation with the Agricultural Conservation Program which paid for compliance $139 for 1938, $134 for 1939 and $141 for 1940. In 1941 the following grain crops were raised: corn 16 acres, oats 4 acres, soybeans for

seed 2 acres, and wheat 23 acres. By 1941 all of the old permanent pasture land had been treated with lime and fertilizer, and the cropland that had been converted to permanent pasture had been limed and fertilized when it was in the rotated area. All of the cropland had been limed by 1941, but little alfalfa had been used in the seeding mixtures. The operator plans to sow alfalfa in the meadow mixtures as the land improves in productivity. Contour strip cropping, contour cultivation, and terracing have been put into operation on the areas suggested in the original conservation plans.

Livestock. The animal units of livestock kept in 1936 were distributed as follows: horses 3.0, dairy cattle 19.0, young cattle 4.0, hogs 1.0 and poultry 1.5. Of the 28.5 animal units of livestock, 26.0 were hay-consuming livestock.

Productivity balance. Estimated changes in the productivity of the cropland are similar to the preceding case studies. For example, under the soil depleting methods of farming in 1936, the productivity of the soil was estimated to be declining at the annual rate of .4 percent, whereas under the proposed conservation program a .4 percent annual increase was estimated.

Feed available. According to computations the amount of feed needed for the amount and type of livestock kept in 1936 was as follows: grain 943 feed units, 1/ silage 30 tons, hay 42 tons and pasture for 26 animal units. Under the prevailing methods of farming 2,315 feed units of grain, 30 tons of silage 42 tons of hay, and pasture for 12 animal units were produced. Under the proposed conservation plans sufficient feed will be produced, but the amount of grain will be reduced to 1,937 feed units.

Provisions for supplementary pasture include grazing the meadows after the first cutting of hay is made. On the preceding case farms where no strip cropping was recommended, pasturing the meadows created no additional problems.

1/ A feed unit is equal to: 1 bu. corn, 2 bu. oats, or .9 bu. wheat.

Reference to figure 4 shows that approximately one-half of the strip cropped land will be in corn and meadow and the other half in wheat and meadow each year. When the strips are in wheat and meadow supplementary pasture may be provided by pasturing the strips after the wheat is harvested and the first cutting of hay is made. This would not involve fencing each strip separately with a temporary fence, since approximately one-half of the strip cropped land would be in wheat and meadow each year and thus could be fenced together. Using a temporary fence to connect the strips with one of the permanent pasture fields should solve the problem of providing water for the livestock.

If the new meadow seedings are pastured after the wheat is harvested care should be taken to prevent overgrazing, otherwise the stand may be weakened and the production of hay may be reduced the following year. On this farm supplementary pasture may be provided by the 10.2 acres that will be contour cultivated, the 12.5 acres that will be terraced, and the two fields of permanent meadows containing 7.9 acres and 6.3 acres of land. If supplementary pasture is needed before the second growth of hay develops, pasturing a meadow instead of making a first cutting of hay may be advisable. On farms where all of the cropland is strip cropped some permanent meadows may be established to provide sufficient supplementary pasture. The operator of the farm has used only permanent pasture, but he plans to provide supplementary pasture in the future by methods similar to the above suggestions. The use of supplementary pasture on this farm has been neglected because the farmer did not appreciate the advantages of this crop.

Labor and power. Computations show the following reductions in labor and power under the new farm organization: man hours 29 percent, horse hours 29 percent, and tractor hours 52 percent. No greater peaks in labor demands will occur under the recommended farm plans than under the prevailing methods of farming.

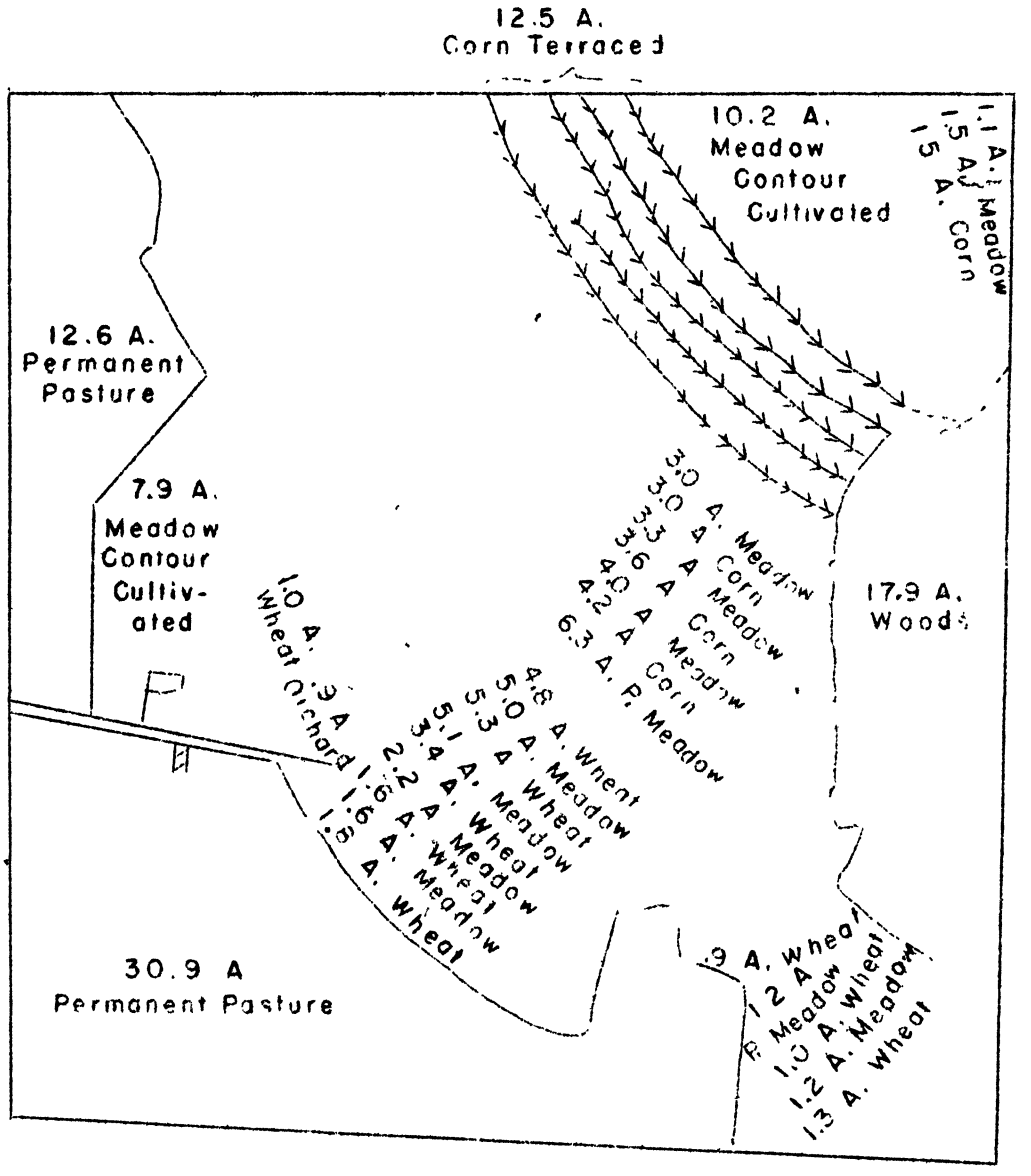

Figure 4. Land Use in 1941 on a 167-acre Farm with Light Soil, Muddy-Fork Watershed

Labor income. As in the case of the preceding farm, labor income may be maintained by reducing cash expenditures for labor and power or raising more livestock. Since additional labor is hired this item of expense may be reduced to the extent of the labor saved in crop production under the conservation plans. Cash expenses also can be reduced by using the tractor less. Raising more livestock is an alternative that might be followed to utilize the labor displaced in crop production. By reducing cash expenses or increasing the amount of livestock, labor income should be maintained or even increased under the conservation methods of farming.

Other Adjustments

The preceding case studies illustrate some of the adjustments possible in making recommended soil and water conservation programs fit into present farm organizations. However, many more combinations would be possible than the ones discussed in these illustrations. For example, adjustments might be made in any one or all of the livestock enterprises on the farm, however, adjustments are most likely to occur in the hay-consuming livestock enterprises. Adjustments also might be made in regard to improving the type of livestock, but these would be more difficult and would involve more time and capital than in the case of small increases in the amount of livestock. The four case studies illustrate the problems involved on the small and large farms in the area. Farms in between these two sizes would present a combination of problems of the two groups and adjustments probably would be made by reducing both the cash expenses for labor and power and making small increases in the amount of livestock. In the case of tenant-operated farms where a large volume of business is desired, adjustments probably would be made by utilizing the hay and pasture most efficiently by increasing the number of hay-consuming animals.

Summary

In this report consideration has been given to some of the ways in which the recommended soil and water conservation program may be made to fit into an effective farm organization on the farms in the Muddy-Fork Demonstration Area at Wooster, Ohio. In planning farms for soil and water conservation in this area, consideration should be given to the following points:

General Considerations for All Farms in the Muddy-Fork Project.

1. Provisions should be made for supplementary pasture, by pasturing the meadows, otherwise a deficiency in pasture will occur in July and August when the production of permanent pasture is greatly reduced. On areas that are strip-cropped, pasturing the meadows will require temporary fences.

2. The cropland should be limed and alfalfa should be included in the meadow seeding, otherwise the second year hay will be timothy.

3. Less grain and more hay will be available under the conservation type of farming. This will involve a maximum use of hay in the ration and the reduction of the grain-consuming animals to the minimum if the feed produced on the farm is to be used most profitably.

4. Less labor and power will be required under the new farm organization. Therefore, provision must be made to reduce the cash expenses for these items or use the displaced labor in some other manner if the farm income is to be maintained. On some farms, this may be done by increasing the amount of livestock raised. On other farms, the displaced labor may be used for miscellaneous non-farm work.

5. Consideration should be given to the use of grass silage especially on farms which have a silo. This will save corn on farms where the silo was filled with corn, and will enable the farmer to save the hay crop during rainy weather.

Special Considerations for Farms with Heavy Soils.

1. The recommended rotation is corn, oats, wheat, meadow, meadow, instead of the prevailing rotation of corn, oats, wheat, meadow.

2. Oats are recommended in the rotation since the corn is often harvested too late to sow wheat at the proper time. Since the heavy soils are on level land, oats may be included in the rotation even though they provide no winter cover.

3. Since oats are recommended in the rotation, the livestock rations should include a maximum amount of this crop.

Specific Considerations for Farms with Light Soils.

1. The recommended rotation is corn, wheat, meadow, meadow, instead of the prevailing rotation of corn, oats, wheat, meadow.

2. Oats are not recommended for the light soils which are subject to erosion.

3. Since no oats are recommended for these farms, the livestock rations should include a minimum amount of this crop.

Specific Considerations for Large Farms.

1. Reductions in the cash outlay for labor and power are possible.

2. Labor income may be maintained by reducing cash expenses for labor and power or raising more hay-consuming animals with the labor displaced in crop production.

Specific Considerations for Small Farms.

1. Since the amount of grain produced is often inadequate to meet the demands of the livestock, grain production should not be reduced greatly before more hay of better quality is raised.

2. Cash expenses for labor and power cannot be reduced since all of the work was done by the farm operator and the power was accomplished by one team of horses.

3. Labor income may be maintained by feeding more hay of better quality and by keeping additional livestock with the labor displaced in crop production.

Appendix

Table A. Feed Standards for Livestock a/
(Liberal amount of oats used)

Type of livestock	Kind of Feed					
	Corn bu.	Oats bu.	Wheat bu.	Bran lbs.	Protein supplement	Hay lbs.
1 dairy cow	15.5	17.0	-	200	200	4000
1 A. U. of young cattle	15.0	-	-	-	100	4000
1 horse	25.0	25.0	-	-	-	4000
1 ewe	1.0	1.5	-	-	6	360
1 lamb	2.0	-	-	-	0	140
1000 lb. gain in hogs	70.0	3.5	4.5	-	240	-
100 hens	86.0	22.0	42.0	-	1200	-

a/ Based on the following publication: Sitterley, J. H. - Feed Consumed by Livestock. Ohio State University, Extension Service Bulletin 203, 1940.

Table B. Feed Standards for Livestock a/
(Minimum amount of oats used)

Type of livestock	Kind of Feed						
	Corn bu.	Oats bu.	Wheat bu.	Bran lbs.	Protein supplement lbs.	Hay lbs.	Grass silage lbs.
1 dairy cow	24.0	-	-	200	150	2000	6000
1 A. U. of young cattle	15.0	-	-	-	100	2000	6000
1 horse	35.0	-	-	-	-	4000	-
1 ewe	1.3	.8	-	-	6	360	-
1 lamb	2.0	-	-	-	-	140	-
1000 lb. gain in hogs	70.0	3.5	4.5	-	240	-	-
100 hens	86.0	22.0	42.0	-	1200	-	-

a/ Based on the following publication: Sitterley, J. H. - Feed Consumed by Livestock. Ohio State University, Extension Service Bulletin 203, 1940.

Table C. Prices Used in Calculations

Corn $.60 per bushel.
Oats $.35 per bushel.
Wheat $.85 per bushel.
Hay $8.00 per ton.
Permanent pasture $9.00 per animal unit.
Bran $1.35 per hundredweight.
Oilmeal $2.25 per hundredweight.
Hog supplement $2.50 per hundredweight.
Poultry supplement $4.00 per hundredweight.
Tractor power $.75 per hour.
Horse power $.15 per hour.
Man labor $.25 per hour.